WE CLAIM:

1. A surface acoustic wave element, comprising:

a piezoelectric substrate;

a plurality of inter-digital transducer electrodes on said piezoelectric substrate;

a grating reflector electrode arranged on each side of said plurality of inter-digital transducer electrodes;

a plurality of pad electrodes led from said inter-digital transducer electrodes and said grating reflector electrodes;

pad reinforcing electrodes formed on said pad electrodes, wherein said plurality of pad electrodes includes isolated pad electrodes isolated from an outer periphery of said surface acoustic wave element, and includes adjacent pad electrodes directly adjacent to the outer periphery thereof; and

at least a portion of a connecting electrode between each of said isolated pad electrodes and a corresponding one of said adjacent pad electrodes.

2. A surface acoustic wave device comprising:

a box-shaped base member having a bottom wall and side walls;

a wiring conductor extending through a bottom portion of at least one of said side walls of said base member;

a connecting terminal electrode extending from said wiring conductor at said at least one of said side walls to an outer surface of said bottom wall;

a cover to be connected to a periphery of said base member for sealing said base member; and

a surface acoustic wave element connected to said wiring conductor of said base member, said surface acoustic wave element including:

a piezoelectric substrate;

a plurality of inter-digital transducer electrodes on said piezoelectric substrate;

a grating reflector electrode arranged on each side of said plurality of inter-digital transducer electrodes;

a plurality of pad electrodes led from said inter-digital transducer electrodes and said grating reflector electrodes;

pad reinforcing electrodes formed on said pad electrodes, wherein said plurality of pad electrodes includes isolated pad electrodes isolated from an outer periphery of said surface acoustic wave element, and includes adjacent pad electrodes directly adjacent to the outer periphery thereof; and

at least a portion of a connecting electrode between each of said isolated pad electrodes and a corresponding one of said adjacent pad electrodes.

3. A surface acoustic wave element manufacturing method, comprising:

forming a plurality of surface acoustic wave elements, each of the surface acoustic wave elements including a plurality of inter-digital transducer electrodes on a piezoelectric substrate, a grating reflector electrode arranged on each side of the plurality of inter-digital transducer electrodes, and a plurality of pad electrodes led from the inter-digital transducer electrodes and led from the grating reflector electrodes;

forming dicing lines on an outer periphery of each surface acoustic wave element so that the plurality of pad electrodes of each surface acoustic wave element includes a plurality of isolated pad electrodes electrically isolated from the dicing lines, and includes a plurality of adjacent pad electrodes directly adjacent to at least one of the dicing lines;

forming connecting electrodes for electrically connecting the isolated electrodes to a corresponding one of the adjacent pad electrodes;

forming short-circuit electrodes for electrically connecting the adjacent pad electrodes to at least one of the dicing lines;

forming pad reinforcing electrodes on the pad electrodes;

removing at least a portion of each connecting electrode to electrically disconnect each isolated pad electrode from the corresponding one of the adjacent pad electrodes; and

cutting the piezoelectric substrate along the dicing lines.

4. The surface acoustic wave element manufacturing method of claim 3,

further comprising forming bumps on the pad reinforcing electrodes.

5. The surface acoustic wave element manufacturing method of claim 4,

wherein said removing of at least a portion of each connecting electrode is performed after said forming of the bumps.

6. The surface acoustic wave element manufacturing method of claim 3,

wherein said cutting of the piezoelectric substrate comprises dicing the piezoelectric substrate along the dicing lines so that the cut has a width greater than the width of the dicing line.

7. The surface acoustic wave element manufacturing method of claim 3,

wherein said removing of at least a portion of each connecting electrode is performed after said forming of the pad reinforcing electrodes.

8. The surface acoustic wave element manufacturing method of claim 3,

wherein said removing of at least a portion of each connecting electrode comprises at least one of wet etching and dry etching.

9. The surface acoustic wave element manufacturing method of claim 3,

wherein each connecting electrode comprises a metal film soluble in a developing solution for photoresist; said removing of at least a portion of the connecting electrode comprises:

coating a photoresist on the piezoelectric substrate;

exposing the photoresist so as to make a portion of the photoresist corresponding to at least a portion of each connecting electrode soluble in the developing solution;

developing the photoresist in the developing solution; and

etching the at least a portion of each connecting electrode in the developing solution simultaneously with said developing.

10. The surface acoustic wave element manufacturing method of claim 3, wherein said

removing of at least a portion of each connecting electrode includes simultaneously etching at least a portion of each short-circuit electrode to electrically disconnect each adjacent pad electrode from the dicing lines.

11. The surface acoustic wave element manufacturing method of claim 3, further comprising etching at least a portion of each of the short-circuit electrodes so as to electrically disconnect each adjacent pad electrode from the dicing lines, wherein a process for performing said removing of at least a portion of each connecting electrode is identical to a process for performing said etching of at least a portion of each short-circuit electrode.

12. A surface acoustic wave device manufacturing method, comprising:

manufacturing a surface acoustic wave element by:

forming a plurality of surface acoustic wave elements, each of the surface acoustic wave elements including a plurality of inter-digital transducer electrodes on a piezoelectric substrate, a grating reflector electrode arranged on each side of the plurality of inter-digital transducer electrodes, and a plurality of pad electrodes led from the inter-digital transducer electrodes and led from the grating reflector electrodes;

forming dicing lines on an outer periphery of each surface acoustic wave element so that the plurality of pad electrodes of each surface acoustic wave element includes a plurality of isolated pad electrodes electrically isolated from the dicing lines, and includes a plurality of adjacent pad electrodes directly adjacent to at least one of the dicing lines;

forming connecting electrodes for electrically connecting the isolated electrodes to a corresponding one of the adjacent pad electrodes;

forming short-circuit electrodes for electrically connecting the adjacent pad electrodes to at least one of the dicing lines;

forming pad reinforcing electrodes on the pad electrodes;

removing at least a portion of each connecting electrode to electrically disconnect each isolated pad electrode from the corresponding one of the adjacent pad electrodes; and

cutting the piezoelectric substrat along the dicing lines to produce the surface

acoustic wave element;

forming a box-shaped base member having a wiring conductor extending through a bottom portion of a side wall of the base member;

connecting the surface acoustic wave element to the wiring conductor of the base member;

forming a connecting terminal electrode so that the connecting terminal electrode extends from the side wall at the wiring conductor to an outer surface of a bottom wall of the base member; and

adhesively sealing a cover to the base member by a connecting member after positioning the cover so that the cover is supported by a peripheral portion of the base member.

[Description of the Reference Numerals]

1, 11 Piezoelectric substrate

2, 12 Dicing line

5 Ground terminal

191, 192, 193 Connecting electrode

7, 181, 182, 183, 184, 185, 186 Short-circuit electrode

8 Input terminal

15 Terminal electrode

17 Lead electrode

21 Bump

31,32, 33 IDT electrode

38 SAW element

40 SAW device

41, 42, 141, 142 Grating reflector electrode

44 Connecting electrode pad

46 Cover

47 Connecting member

51 Base member

52 Wiring conductor

53 Connecting terminal electrode

54 Photoresist

61, 62, 63, 64, 65, 66, 67 Pad electrode

131, 135 Outer IDT electrode

132, 134 Inner IDT electrode

133 Central IDT electrode

161, 162, 165 Isolated pad electrode

163, 164,166,167 Adjacent pad electrode

201, 202, 203, 204, 205, 206, 207 Pad reinforcing electrode

541 Exposed portion